CLAIMS

1. A magnetic sensor which comprises a plurality of magnetoresistive elements formed on an upper surface of a layer superposed on a substrate, and a plurality of heat generating elements adapted to generate heat when electrically energized, and which, on the basis of resistance values of said plurality of magnetoresistive elements, generates an output value corresponding to an external magnetic field acting on said magnetoresistive elements, characterized in that

said plurality of heat generating elements are arranged and configured in such a way that, when each of said plurality of heat generating elements generates a quantity of heat approximately equal to the quantity of heat generated by any one of the remaining heat generating elements, the temperatures of said plurality magnetoresistive elements become approximately equal to one another, and the temperature of the upper surface of said layer on which said plurality of magnetoresistive elements are formed becomes nonuniform.

2. A magnetic sensor according to claim 1, wherein

said plurality of magnetoresistive elements are arranged to form a plurality of island-like element groups, each including a plurality of magnetoresistive elements which are identical in magnetic field detecting direction and arranged adjacent to each other on the upper surface of said layer; and

said heat generating elements are formed such that one is located above or beneath each element group.

3. A magnetic sensor according to claim 2, wherein

said heat generating element assumes the form of a coil capable of applying to said magnetoresistive elements formed above or beneath said heat generating element a magnetic field in a direction approximately identical with or approximately perpendicular to the magnetic field detecting direction of said magnetoresistive elements.

4. A magnetic sensor which comprises a plurality of magnetoresistive elements formed on an upper surface of a layer superposed on a substrate, and a single heat generating element for generating heat when electrically energized, and which generates an output value corresponding to an external magnetic field acting on the magnetoresistive elements, on the basis of resistance values of said plurality of magnetoresistive elements, characterized in that

said heat generating element is arranged and configured in such a manner that the temperatures of said plurality of magnetoresistive elements become approximately equal to one another, and that the temperature of the upper surface of said layer on which said plurality of magnetoresistive elements are formed becomes nonuniform.

5. A magnetic sensor according to claim 4, wherein

said heat generating element and said plurality of magnetoresistive elements are configured in such a manner that the quantity of heat to be propagated from said heat generating element to an arbitrary one of said plurality of magnetoresistive elements becomes approximately identical with

the quantity of heat to be propagated from said heat generating element to one of the remaining magnetoresistive elements.

6. A magnetic sensor according to claim 4, wherein

said heat generating element and said plurality of magnetoresistive elements are configured in such a manner that a relative positional relation between said heat generating element and an arbitrary one of said plurality of magnetoresistive elements becomes approximately identical with the relative positional relation between said heat generating element and one of the remaining magnetoresistive elements.

7. A magnetic sensor according to claim 5, wherein

said heat generating element and said plurality of magnetoresistive elements are configured in such a manner that a relative positional relation between said heat generating element and an arbitrary one of said plurality of magnetoresistive elements becomes approximately identical with the relative positional relation between said heat generating element and one of the remaining magnetoresistive elements.

8. A magnetic sensor according to claim 1, wherein

said plurality of magnetoresistive elements are arranged separately in four islands spaced from one another on the upper surface of the layer superposed on said substrate, and are formed in such a way that, when said plurality of magnetoresistive elements are rotated within a plane parallel to the upper surface of the layer through 90° about a centroid of a quadrilateral figure defined by four straight lines each interconnecting approximate

centers of adjacent islands, an arbitrary one of the islands becomes substantially aligned with a position which before the angular movement through 90° had been occupied by another island that is adjacent to the arbitrary island in the direction of the angular movement.

9. A magnetic sensor according to claim 4, wherein

said plurality of magnetoresistive elements are arranged separately in four islands spaced from one another on the upper surface of the layer superposed on said substrate, and are formed in such a way that, when said plurality of magnetoresistive elements are rotated within a plane parallel to the upper surface of the layer through 90° about a centroid of a quadrilateral figure defined by four straight lines each interconnecting approximate centers of adjacent islands, an arbitrary one of the islands becomes substantially aligned with a position which before the angular movement through 90° had been occupied by another island that is adjacent to the arbitrary island in the direction of the angular movement.

10. A magnetic sensor according to claim 1,

further comprising:

a temperature detecting section that outputs, as a detection temperature, a temperature having a constant correlation with the temperature of at least one of said plurality of magnetoresistive elements when the temperatures of said plurality of magnetoresistive elements become approximately equal to one another, and the temperature of the upper surface of said layer on which said plurality of magnetoresistive elements are formed becomes nonuniform.

11. A magnetic sensor according to claim 4,

further comprising:

a temperature detecting section that outputs, as a detection temperature, a temperature having a constant correlation with the temperature of at least one of said plurality of magnetoresistive elements when the temperatures of said plurality of magnetoresistive elements become approximately equal to one another, and the temperature of the upper surface of said layer on which said plurality of magnetoresistive elements are formed becomes nonuniform.

12. A magnetic sensor according to claim 10, wherein

said plurality of magnetoresistive elements are interconnected in such a way that, among said magnetoresistive elements, elements identical in magnetic field detecting direction constitute a bridge circuit in order to generate an output value corresponding to said external magnetic field; and

said magnetic sensor further comprises:

a memory, and

temperature-dependent characteristic writing means for writing into said memory a value that is determined on the basis of data representing a first temperature of said magnetoresistive elements, determined on the basis of the detection temperature output from said temperature detecting section, and a first output value output from said magnetic sensor at the first temperature, and data representing a second temperature of said magnetoresistive elements, different from the first temperature and determined on the basis of the detection temperature output from said

temperature detecting section, and a second output value output from said magnetic sensor at the second temperature, the value to be written into said memory corresponding to a ratio of a difference between the first and second output values to a difference between the first and second temperatures .

13. A magnetic sensor according to claim 11, wherein

said plurality of magnetoresistive elements are interconnected in such a way that, among said magnetoresistive elements, elements identical in magnetic field detecting direction constitute a bridge circuit in order to generate an output value corresponding to said external magnetic field; and

said magnetic sensor further comprises:

a memory, and

temperature-dependent characteristic writing means for writing into said memory a value that is determined on the basis of data representing a first temperature of said magnetoresistive elements, determined on the basis of the detection temperature output from said temperature detecting section, and a first output value output from said magnetic sensor at the first temperature, and data representing a second temperature of said magnetoresistive elements, different from the first temperature and determined on the basis of the detection temperature output from said temperature detecting section, and a second output value output from said magnetic sensor at the second temperature, the value to be written into said memory corresponding to a ratio of a difference between the first and second output values to a difference between the first and second temperatures .

14. A method of compensating a temperature-dependent characteristic of a magnetic sensor which includes a magnetoresistive element whose resistance varies according to an external magnetic field, a first memory, a temperature detecting section for outputting, as a detection temperature, a temperature having a constant correlation with the temperature of said magnetoresistive element, and a heat generating element for generating heat when electrically energized; and which generates an output value corresponding to the external magnetic field on the basis of a resistance value of said magnetoresistive element; said magnetic sensor being adapted for incorporation in an electronic apparatus which includes a permanent magnet component, a casing, and a second memory, wherein said casing accommodates said magnetic sensor, said permanent magnet component, and said second memory; said method comprising the steps of:

obtaining a first temperature of said magnetoresistive element on the basis of the detection temperature output from said temperature detecting section, and obtaining a first output value output from said magnetic sensor at the first temperature, before said magnetic sensor is accommodated in said casing;

changing the electrically energized state of said heat generating element, before said magnetic sensor is accommodated in said casing;

obtaining a second temperature of said magnetoresistive element on the basis of the detection temperature output from said temperature detecting section, and obtaining a second output value output from said magnetic sensor at the second temperature, before said magnetic sensor is accommodated in said casing;

storing into said first memory a value corresponding to a ratio of a difference between said first and second output values to a difference between said first and second temperatures;

storing into said second memory, as reference data, an offset value of the output value of said magnetic sensor and a detection temperature output from said temperature detecting section after said magnetic sensor is accommodated in said casing together with said permanent magnet component; and

subsequently correcting the output value of said magnetic sensor on the basis of the value corresponding to the ratio stored in said first memory, the reference data stored in said second memory, and the detection temperature output from said temperature detecting section.

15. A magnet sensor comprising a single substrate, a plurality of magnetoresistive elements, a wiring section interconnecting said plurality of magnetoresistive elements, and a control circuit section for obtaining via said wiring section a physical quantity determined on the basis of resistance values of said plurality of magnetoresistive elements and processing the physical quantity so as to generate an output signal to be output to the outside, wherein

said magnetic sensor further includes a plurality of layers superposed on said substrate; said magnetoresistive elements are formed on an upper surface of one of said plurality of layers; said wiring section and said control circuit section are formed in said substrate and said plurality of layers; and said magnetoresistive elements, said wiring section, and said control circuit section are interconnected in said plurality of layers by a

connection section formed of a conductive substance and extending along a direction intersecting layer surfaces of said layers.

16. A magnetic sensor comprising a substrate, a plurality of magnetoresistive elements disposed at an upper portion of said substrate, a wiring section disposed at the upper portion of said substrate and interconnecting said plurality of magnetoresistive elements, and a control circuit section for obtaining via said wiring section a physical quantity determined on the basis of resistance values of said plurality of magnetoresistive elements and processing the physical quantity so as to generate an output signal to be output to the outside, wherein

said plurality of magnetoresistive elements are disposed at a peripheral portion of said substrate as viewed in plan;

said wiring section is disposed so as to form substantially a closed curve as viewed in plan; and

said control circuit section is disposed substantially inside said closed curve as viewed in plan.

17. A magnetic sensor comprising a single substrate and a plurality of element groups, each element group including a pair of magnetoresistive elements which are identical in terms of magnetization direction of a pinned layer, wherein

each of said plurality of element groups is disposed at an upper portion of said substrate in such a way that the magnetization direction of said pinned layer of each element group is substantially parallel to a direction in which a distance from a centroid of said substrate increases,

and such that said pair of magnetoresistive elements are disposed adjacent to each other in that direction.